635 Burney

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A COMPARISON OF BENEFITS OBTAINED BY DIRECT AND INDIRECT METHODS OF BARK-BEETLE CONTROL IN THE BURNEY AREA, SHASTA COUNTY, CALIFORNIA

by

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INTRODUCTION

During 1944 an epidemic of tree-killing bark beetles, Ips oregoni Eich., and Ips confusus Lec., occurred in the ponderosa pine stands of the Burney Area, Shasta County, California, and it became necessary to combat the infestation by direct fell-peel-burn methods of control. State, private, and Federal agencies joined in this cooperative project on 26,700 acres of timbered lands. From an inventory of beetle-killed trees on several sample plots following the control program, it was found that a marked reduction in this infestation had taken place but an endemic infestation of the western pine beetle, Dendroctonus brevicomis Lec., still persisted in the area. In the hope of preserving the benefits of the 1945 control work, and pending the application of indirect measures for more lasting benefits by sanitation-salvage cuttings, both state and private agencies felt it was desirable to continue direct control on a maintenance basis. As a result, felling, peeling, and burning of infested trees was undertaken again in 1946 on a portion of this area. At the same time, indirect control by the selective removal of high risk trees was initiated on 2,200 acres of lands which had been without benefit of previous direct control treatment. Also, sanitation-salvage cutting, modified by peeling and burning unmerchantable portions of infested trees, was attempted on 780 acres surrounding the Burney Falls State Park in an effort to further improve results expected from the sanitation-salvage cutting alone.

The control procedures followed during 1946 offer an excellent opportunity to compare the benefits of direct and indirect methods of control in reducing bark-beetle-caused loss under almost identical conditions of areas and infestations. This report makes that comparison.

REVIEW OF THE CONTROL PROGRAMS

1. Direct control by fell-peel-burn.

During the control program in 1945, merchantable portions of all infested trees were salvaged by local saw mills. Salvage was not possible in the maintenance control program during 1946 because of the scattered nature of the endemic infestation of western pine beetle. Therefore, during 1946, 177 trees on 6,760 acres were felled, peeled, and burned.

2. Indirect control by sanitation-salvage cutting.

One portion of the Burney Area was not included in the program of direct control in 1945 and, since this area had been without benefit of previous

treatment, it was selected as most in need of sanitation-salvage cuttings in 1946. During March and April, a total of 1,471 trees of high risk to beetle attack and 357 other trees than currently infested were cut and removed from 2,200 acres of land in this indirect control program.

3. Indirect control by modified sanitation-salvage cutting.

In an attempt to prevent an infiltration of bark beetles from surrounding timber and thus provide for additional protection to the green trees in the Burney Falls State Park, a 2,400-acre zone of maintenance was established in lands of Federal and private ownership surrounding the park area. It was the purpose here to control bark beetles on an annual basis similar to the program maintained within the State Park. Control in this "buffer zone" during 1946 varied with respect to methods according to ownership of lands. Protection on a long-term basis through sanitation-salvage cutting was possible only on 750 acres of lands in private ownership. The remaining acreage was treated by fell-peel-burn methods. In the attempt to further benefit control expected by sanitation-salvage cutting, peeling and burning of all unmerchantable portions of 10% infested trees was done on the 750 acres cut.

COMPARISON OF CONTROL RESULTS

Following the control operations in 1946, several half-section plots were established in the areas treated by direct and indirect methods, and in surrounding stands which had remained in a virgin status, in order that losses subsequent to control could be compared to uncontrolled stands nearby. Supplementary loss data on all areas were obtained from roadside sample strips previously located in these stands. Locations of the sample plots and the areas treated by the three methods of control are shown on the appended map. The record and comparison of loss on all areas are given in the appended table and summarized as follows:

	Acres sampled	PINE LOSS - BOARD FEET PER ACRE Before control 1945	After control 1946	After control 1947
Virgin areas	1,626	65.1	49.1	62.3
Direct fell-peel-burn maintenance control	2,532	55.9	66.7	86.5
Indirect control through sanitation-salvage cutting	1,176	111.0	27.4	17.4
Indirect control through modified sanitation-salvage cutting	676	82.1	24.0	6.2

1. Fell-peel-burn control.

A comparison of the seasonal loss in virgin stands and in the areas controlled by fell-peel-burn methods (Table 1) shows that the average per-acre loss was almost identical on both areas during 1945. However, during 1946, subsequent to the second year's maintenance control program, losses increased 19 percent on the control area where there was a seasonal drop in loss of 25 percent in virgin stands. In 1947, the trend of loss on both areas was upward in exact proportions. These records indicate that the fell-peel-burn control in 1946 was of no benefit in further reducing the low level of endemic loss which resulted from the control action in 1945.

2. Sanitation-salvage control.

A comparison of the seasonal loss in virgin stands and the area cut over by sanitation-salvage methods (Table 1) shows a considerable spread in the rate of loss between these areas subsequent to cutting. In the first year, the amount of loss dropped 75 percent on the cut area, whereas there was but a 25-percent decrease in the loss rate in virgin stands. The second year, losses in virgin stands increased 27 percent, whereas the loss on cut areas decreased another 36 percent. In effect, the cutting resulted in a 44 percent reduction in loss immediately following cutting and a 72 percent reduction the second year.

3. Modified sanitation-salvage control.

In the comparison of the annual rate of loss between virgin stands and the area where peeling and burning of cull material from infested trees supplemented indirect control through sanitation-salvage cutting (Table 1), it is found that a slight improvement in control benefits was obtained the first year over and above the marked reduction due to sanitation-salvage. A much greater reduction in loss is indicated for the second year. As compared to virgin stands, this modified sanitation-salvage treatment reduced losses by 51 percent the first year and 90 percent the second year.

DISCUSSION AND CONCLUSIONS

1. Fell-peel-burn control.

Direct control by fell-peel-burn methods against an epidemic infestation of Ips engraver beetles in 1945 resulted in a marked reduction in loss. An additional fell-peel-burn treatment during 1946 against an endemic infestation of western pine beetle was of no benefit in further reducing loss obtained by control in 1945. Actually, the subsequent infestation on this maintenance control area rose above the level on surrounding virgin stands, indicating that direct control in these stands is effective only against infestations and loss of an epidemic nature and is not effective against a low endemic of western pine beetle.

A possible explanation for the increased loss on the area treated by direct methods, rather than the expected decrease, is that the two consecutive years of fell-peel-burn control tended to hold down beetle populations while allowing high risk trees to accumulate on the area. Then, when the beetles were no longer hindered by control, they increased their numbers rapidly in the high risk trees and soon caused more loss than resulted normally on areas where the populations progressed

2. Sanitation-salvage control.

The purpose of indirect control through sanitation-salvage cutting is to remove trees which are known to be of high risk to attack by bark beetles and serve as a source for breeding. As a result, and without action to destroy populations by direct means, it is possible to obtain protection for longer periods and to a greater degree than can be gained by methods designed only to kill bark-beetle broods. In addition, the removal of high risk trees from the stand before they become infested provides for their utilization, a benefit not always possible when control

is attempted by direct methods after these trees become infested. In contrast to control by direct methods, the benefits of the selective cuttings are obvious. Also, protection on these cut areas is expected for several more years.

3. Modified sanitation-salvage control.

The peeling and burning of unmerchantable portions of infested trees as a measure of control to supplement sanitation-salvage cuttings indicates that added control benefits were obtained. The writer is doubtful, however, if the added benefits indicated were actually obtained. It is not logical to conclude that direct methods supplementing sanitation-salvage cuttings would further benefit control, particularly the second year after treatment, when these methods failed to affect the rate of loss on areas where they were used alone. Also, in the writer's opinion, the added benefit in control does not justify the added expense of treatment.

RECOMMENDATIONS

The primary purpose of the maintenance fell-peel-burn control program in 1946 was to preserve the benefits gained by similar control the previous year and prevent any increase in loss until an action program could be developed for the selective cutting of the area by sanitation-salvage methods. All high risk trees were cut on federally owned lands during the winter period of 1947-1948. However, thus far no action has been taken for the selective cutting of privately owned lands which had been protected by direct control during 1945 and 1946. In order to forestall possible additional heavy loss, and prevent the possibility of contamination to the surrounding timber, it is urged that the remaining area treated by fell-peel-burn control during 1945 and 1946 be cut by sanitation-salvage methods as soon as possible.

Table 1.--Record of pine loss in virgin stands and on areas treated by fell-peel-burn, sanitation-salvage, and modified sanitation-salvage control.

Status of Sample	Sample Plot No.	Acres in Sample	1945 Pine Loss: No. of Trees	1945 Pine Loss: Volume b.m.	1945 Pine Loss: Volume per Acre	Status of Sample	1946 Pine Loss: No. of Trees	1946 Pine Loss: Volume b.m.	1946 Pine Loss: Volume per Acre	Ratio 46/45	Status of Sample	1947 Pine Loss: No. of Trees	1947 Pine Loss: Volume b.m.	1947 Pine Loss: Volume per Acre	Ratio 47/46
A*	P-4	240	10	12,310	51.3	A*	6	7,430	30.9		A*	12	21,920	91.3	
	5	320	15	10,820	33.8		11	19,970	62.4			Cutover			
	6	320	17	16,900	52.8		20	20,130	62.9			3	840	3.4	
	9	280	9	4,350	15.0		17	24,390	84.1			3	7,510	25.9	
	RE-7	264	20	21,110	86.5		9	9,330	38.2			27	27,860	114.2	
	8	32	4	3,360	105.0		0	0	0.0			1	220	6.9	
	9	320	61	42,370	132.4		31	2,500	7.8			3	1,660	18.9	
	RSE-6	20	2	5,150	257.5		3	3,280	164.0			7	9,680	484.0	
	12	20	2	470	23.5		4	2,630	131.5			0	0	0.0	
	13	20	2	2,030	101.5		0	0	0.0			0	0	0.0	
Total		1,826	142	118,870			73	89,640				66	69,390		
Average					65.1				49.1	0.75				62.3	1.27
B*	P-10	320	19	14,080	44.0	B* 1/	42	31,550	98.6			23	22,780	71.2	
	11	320	20	30,750	96.1		27	29,380	91.8			28	24,720	77.2	
	12	320	15	9,950	31.1		16	16,900	52.8			20	18,770	58.7	
	13	320	13	19,420	60.7		13	18,620	58.2			19	19,980	62.4	
	14	320	17	11,390	35.6		12	14,110	44.1			25	33,920	106.0	
	RE-1	320	22	18,850	58.9		25	15,650	48.9			28	20,900	65.3	
	2	280	25	21,360	76.3		17	19,070	68.1			47	42,170	105.6	
	3	56	(No record available)				6	3,770	67.3			5	6,680	119.3	
	4	128	8	7,540	58.9		12	8,910	69.6			14	15,360	120.0	
	5	112	8	4,040	36.1		8	6,060	75.5			12	8,660	77.4	
	6	32	3	1,810	56.5		4	1,810	44.1			5	5,840	182.5	
	RSE-4	20	0	0	0.0		0	0	0.0			0	0	0.0	
	7	20	1	30	1.5		4	4,730	236.5			8	4,140	207.0	
	9	20	1	2,260	113.0		0	0	0.0			0	0	0.0	
Total		3,532	152	141,480			186	172,560				232	223,920		
Average					55.9				66.7	1.19				86.5	1.30
C*	P-1	320	35	31,610	98.8	C* 1/	13	8,640	27.0			6	5,750	18.0	
	2	320	22	20,900	65.3		5	1,630	5.1			14	8,640	27.0	
	3	320	36	32,360	101.1		30	17,220	53.8			5	2,710	8.5	
	5	320	17	13,990	42.5	(Virgin)					Cut '47	2	3,520	11.0	
	6	160	9	8,450	52.8	(Virgin)					Cut '47	4	1,660	10.4	
	RE-7	36	3	3,120	86.7		8	2,280	63.3			0	0	0.0	
	8	160	22	16,810	105.1		3	2,240	14.0			6	4,000	25.0	
	RSE-11	20	7	3,720	186.0		1	210	10.5			2	2,470	123.5	
Total		1,176	151	130,560			57	32,220				41	28,760		
Average					111.0				27.5	0.25				17.4	0.63
D*	Sec. 2	80	3	1,870	23.4	D* 1/	0	0	0.0			1	1,460	36.5	
	Sec. 3	360	33	39,180	108.8		14	13,240	36.8			3	2,510	7.0	
	Sec. 5	120	11	11,850	98.7		3	1,840	15.3			0	0	0.0	
	RD-3	136	2	2,590	19.0		5	1,120	8.2			1	230	1.7	
	RSE-1	20	0	0	0.0		0	0	0.0			0	0	0.0	
Total		676	49	55,490			22	16,200				5	4,200		
Average					82.1				24.0	0.29				6.2	0.26

RECAPITULATION OF LOSS RECORD

A*	1,826	142	118,870	65.1	73	89,640	49.1	0.75	66	69,390	62.3	1.27
B*	2,532	152	141,480	55.9	186	172,560	66.7	1.19	232	223,920	86.5	1.30
C*	1,176	151	130,560	111.0	57	32,220	27.4	0.25	41	28,760	17.4	0.64
D*	676	49	55,490	82.1	22	16,200	24.0	0.29	5	4,200	6.2	0.26

A* Virgin stands
B* Peel-burn control
B* 1/ Maintenance-peel-burn control
C* Virgin stands, prior to peel-burn control
C* 1/ Sanitation-salvage control
D* Fell-peel-burn control, prior to modified sanitation-salvage control
D* 1/ Modified sanitation-salvage control

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BURNEY FLAT INSECT CONTROL UNIT
SHASTA COUNTY, CALIFORNIA

SCALE
0 1 2
MILES

Lake Britton
DAM
Fish Hatchery
State Park
Four Corners
STATE
Burney Spr. Mt.
Long Valley Mt.
Lookout 4532 30 Mt.
Black Ranch
DAM
Blue L.
Transmission
3823 Brush Mt.
Burney
Burney 20
Hat Cr.
DAM
BM 3111
BM 3234
WRL 9-46

T. 36 N.

T. 35 N.

BOUNDARIES

- ENTOMOLOGICAL UNIT
- SAMPLE PLOTS
- BURNEY FALLS STATE PARK MAINTENANCE ZONE

LEGEND

- FELL-PEEL-BURN CONTROL '45 & '46
- SANITATION-SALVAGE CONTROL 1946
- SANITATION-SALVAGE CONTROL 1947
- SANITATION-SALVAGE CONTROL 1948
- MODIFIED SANI-SALV CONTROL 1946
- VIRGIN STANDS
- CUTOVER LANDS AS OF 1/1/48
- (6) SAMPLE PLOTS
- RD-3 ROAD SIDE STRIPS